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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/524,341	02/11/2005	Taiga Goto	1141/73790	6947
23432	7590	07/05/2007		
COOPER & DUNHAM, LLP 1185 AVENUE OF THE AMERICAS NEW YORK, NY 10036			EXAMINER CORBETT, JOHN M	
			ART UNIT 2882	PAPER NUMBER
			MAIL DATE 07/05/2007	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	Application No. 10/524,341	Applicant(s) GOTO ET AL.	
	Examiner John M. Corbett	Art Unit 2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 11 February 2005.
- 2a) ☐ This action is FINAL.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 11 February 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>11 February 2005</u> . | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Drawings*

1. The drawings are objected to because ...

In Figure 15A, it is unclear to the Examiner as to the variable represented by the ordinate (N) in the diagram. Perhaps the variable "Z" was meant to be represented.

In Figure 16, box S4, "DETERMINE PHASE RANGE OF EACH PROJECTION DATA USED FOR EACH" is indicated. Perhaps "DETERMINE PHASE RANGE OF EACH PROJECTION DATA USED FOR EACH VOXEL" was meant.

In Figure 30, oval block at top of diagram, "STAR" is indicated. Perhaps "START" was meant.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the

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renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

### *Specification*

2. The disclosure is objected to because of the following informalities, which appear to be minor draft errors including grammatical problems.

In the following format (location of objection; suggestion for correction), the following correction(s) may obviate the objection(s):

(Page 22, line 5; "bed 2 and bed 2" was recited, perhaps "bed 2" was meant),

(Page 24, line 6; "trace 24b" was recited, perhaps "trace 24a" was meant),

(Page 27, line 25; "step 8" was recited, perhaps "step S8" was meant),

(Page 35, line 12; "Fig. 32B" was recited, perhaps "Fig. 32D" was meant),

(Page 37, line 19; "Expression 28" was recited, perhaps "Expression 20" was meant),

(Page 37, lines 20- 21; "Expression 29" was recited, perhaps "Expression 21" was meant),

(Page 51, line 8; "rpitch [mm]" was recited, perhaps "rpitch [mm/(unit time)]" was meant).

Appropriate correction is required.

*Claim Objections*

3. Claims 5-9 and 12 are objected to because of the following informalities, which appear to be minor draft errors including grammatical and/or lack of antecedent basis problems.

In the following format (location of objection; suggestion for correction), the following correction(s) may obviate the objection(s):

(Claim 5, line 10, “[rad]” was claimed, perhaps “radians” was meant),

(Claim 6, line 10; “[rad]” was claimed, perhaps “radians” was meant),

(Claim 8, lines 5-7; “relative moving speed J in the go-around axis direction of the object and said radiation source is expressed by  $J = 2 * N * \text{rpitch}$  ( $N=1, 2, 3 \dots$ )” was claimed, perhaps “relative moving speed in the go-around axis direction of the object and said radiation source is expressed by  $2 * N * \text{rpitch}$  ( $N=1, 2, 3 \dots$ )” was meant (See Page 51, lines 9-11 of applicant’s specification)),

(Claim 9, lines 1-2; “according to claims 7 and 8” was claimed, perhaps “according to claim 8” was meant),

(Claim 9, lines 6 and 7; “[mm]” was claimed, perhaps “millimeters” was meant),

(Claim 12, line 4, “f $\pi$ ” was claimed but the symbol “f” is not defined in the claim),

(Claim 12, line 4, “[rad]” was claimed, perhaps “radians” was meant).

Claims 7-9 are objected to by virtue of their dependency.

Appropriate correction is required.

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4. Claims 7-9 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim cannot depend from any other multiple dependent claim. See MPEP § 608.01(n). Accordingly, the claims 7-9 have not been further treated on the merits.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 5-9 and 12-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to claims 5, 6 and 7, the limitation “polygonal display pixel” is unclear insofar as the meaning is not understood. Therefore the claims are rejected for being indefinite. Claims 8 and 9 are rejected by virtue of their dependency.

With respect to claim 12, the phrase “it is possible” renders the claim indefinite because it is unclear whether the limitations following the phrase are part of the claimed invention.

With respect to claim 13, the term “narrowest” is a relative term that renders the claim indefinite. The term "narrowest" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

With respect to claim 13, the limitation “maximum cone angle ... becomes narrowest” is unclear insofar as the meaning is not understood.

With respect to claim 14, the term “narrowest possible range” is a relative term that renders the claim indefinite. The term "narrowest possible" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

With respect to claim 14, the limitation “phase direction range ... set to the narrowest possible range” is unclear insofar as the meaning is not understood.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Noo et al. (“Single-slice rebinning method for helical cone-beam CT”, 1999, Phys. Med. Biol., Vol. 44, pages 561-570) in view of Avila et al. (6,947,584) and Tuy (6,097,784).

With respect to claim 1, Noo et al. teaches an apparatus comprising:

a radiation source (and a radiation detector arranged opposite to each other (Figure 1), between which a bed with an examinee placed thereon is provided (Page 562, line 11), said radiation source and radiation detector turning around said bed which can be moved with respect to this go-around axis (Page 562, line 11), radiation irradiated from said radiation source and passing through the examinee being detected using said radiation detector (Figure 1); and

reconfiguration means (Page 566, line 33) for creating an image in a region in concern of the object from the detected projection data, wherein said reconfiguration means

determines for each voxel a projection data range capable of back projection having an operating projection data phase width of 180 degrees or more (Page 564, lines 6-7),

superimposes a reconfiguration filter (Page 565, line 16),

assigns weights to data of the same phase or opposite phase for each phase for this projection data range (Page 565, lines 14-15) and

back projects this filter-processed projection data over said determined data range capable of back projection along the irradiation trace of the radiation beam (Page 565, lines 16-18).

Noo et al. fails to explicitly teach creating a three-dimensional tomographic image.

Noo et al. fails to teach three-dimension back projects.

Avila et al. teaches creating a three-dimensional tomographic image (Col. 4, lines 40-52).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Noo et al. to include the three-dimensional tomographic



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imaging of Avila et al., since a person would have been motivated to make such a modification to convey more information to the operator (Col. 1, lines 35-39) as taught by Avila et al.

Tuy teaches three-dimension back projects (Abstract).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the apparatus of Noo et al. as modified above the three-dimensional back projects of Tuy, since a person would have been motivated to make such a modification to achieve high-quality images (Col. 3, lines 21-22) as taught by Tuy.

Note: the limitation that an element is “capable of” performing a function is not a positive limitation but only requires the function to perform. It does not constitute a limitation in any patentable sense.

With respect to claim 2, Noo et al. further teaches wherein when determining said data range, a projection data range is necessarily determined so that the difference in the absolute values of cone angles at both ends of the projection data range used is reduced (Page 564, lines 1-2 and Figure 3a).

With respect to claim 3, Noo et al. further teaches wherein the projection data phase width used is determined so as to be the same phase width for each voxel (Page 563, lines 30-32, Page 564, lines 1-2 and Figure 3a).

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7. Claims 1 and 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh (20030073893) in view of Avila et al.

With respect to claim 1, Hsieh ('893) teaches an apparatus comprising:

a radiation source (12) and a radiation detector (20) arranged opposite to each other (Figure 3), between which a bed (39) with an examinee (18) placed thereon is provided, said radiation source and radiation detector turning around said bed (Figure 3) which can be moved (37) with respect to this go-around axis, radiation irradiated from said radiation source and passing through the examinee being detected using said radiation detector (Paragraph 23); and

reconfiguration means (40) for creating an image in a region in concern of the object from the detected projection data (74), wherein said reconfiguration means

determines for each voxel a projection data range capable of back projection

having an operating projection data phase width of 180 degrees or more (Paragraph 27),

superimposes a reconfiguration filter (Paragraph 28),

assigns weights to data of the same phase or opposite phase for each phase for this projection data range (Paragraph 28) and

three-dimension back projects this filter-processed projection data over said determined data range capable of back projection along the irradiation trace of the radiation beam (Paragraph 28).

Hsieh ('893) fails to explicitly teach creating a three-dimensional tomographic image.

Avila et al. teaches creating a three-dimensional tomographic image (Col. 4, lines 40-52).

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Hsieh ('893) to include the three-dimensional tomographic imaging of Avila et al., since a person would have been motivated to make such a modification to convey more information to the operator (Col. 1, lines 35-39) as taught by Avila et al.

Note: the limitation that an element is “capable of” performing a function is not a positive limitation but only requires the function to perform. It does not constitute a limitation in any patentable sense.

With respect to claim 4, Hsieh ('893) further teaches wherein said projection data range capable of back projection is either 270 degrees or 360 degrees (Paragraph 32).

Note: the limitation that an element is “capable of” performing a function is not a positive limitation but only requires the function to perform. It does not constitute a limitation in any patentable sense.

With respect to claim 5, Hsieh ('893) further teaches wherein  
projection data whose number of images taken per rotation is a multiple of the number of  
sides C of a polygonal display pixel is acquired (Paragraphs 23 and 26, images taken); and  
said reconfiguration means comprises

back projection means (40) for superimposing said reconfiguration filter on this  
projection data,

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grouping data at the same channel position and having projection phases in the go-around direction shifting by  $2N\pi/C$  ( $N=1, 2, 3, \dots$ ) radians at a time (Paragraph 27) and performing back projection to a square image array group by group (Paragraphs 27-28).

8. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hsieh ('893) in view of Avila et al. as applied to claim 1 above, and further in view of Hsieh (6,490,333).

With respect to claim 6, Hsieh ('893) as modified above suggests the apparatus are recited above. Hsieh ('893) further teaches wherein said reconfiguration means

obtains the projection data whose number of images taken per rotation is a multiple of the number of sides  $C$  of a polygonal display pixel (Paragraphs 23 and 26, data obtained),

superimposes the filter on this projection data (Paragraph 28),

groups data at the same channel position and having projection phases in the go-around direction shifting by  $2N\pi/C$  ( $N=1, 2, 3, \dots$ ) radians at a time (Paragraph 27) and

performs back projection to a square image array group by group (Paragraphs 27-28).

Hsieh ('893) fails to teach converts the projection data obtained to data including fan beam data and parallel beam data.

Hsieh ('333) teaches converts the projection data obtained to data including fan beam data and parallel beam data (Col. 2, lines 29-32).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the apparatus of Hsieh ('893) as modified above the converting of Hsieh ('333), since a person would have been motivated to make such a modification to simplify the computations (Col. 6, lines 10-11) as taught by Hsieh ('333).

9. Claims 10-12 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Flohr et al. (5,796,803) in view of Silver (5,889,833), Bruder et al. ("Single-Slice Rebinning Reconstruction in Spiral Cone-Beam Computed Tomography", IEEE Transactions on Medical Imaging, September 2000, Vol. 19, No. 9, Pages 873-887) and Tuy (6,097,784).

With respect to claim 10, Flohr et al. teaches an apparatus comprising:

a radiation source (9) and a radiation detector (2) made up of two-dimensionally arranged detection elements (Figure 1), arranged opposite to each other (Figure 1), between which a bed with an examinee placed thereon is provided (Col. 2, lines 41-42), said radiation source and radiation detector turning around said bed which can be moved with respect to this go-around axis (Col. 1, lines 57-59), radiation irradiated from said radiation source and passing through said examinee being detected using said radiation detector (Col. 2, lines 44-45); and

reconfiguration means (7) for creating a three-dimensional tomographic image in said region in concern of the examinee from the detected projection data, wherein said reconfiguration means

calculates an approximation for a curve indicating the radiation source position with respect to said channel direction position of parallel beam projection data

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corresponding to said region in concern obtained by a parallel beam of a parallel shape viewed from the go-around axis direction generated from said radiation source (Col. 5, lines 15-53),

corrects each row of the projection data by multiplying a coefficient which is dependent on the angle of inclination of radiation from said radiation source (Col. 5, line 53 – Col. 6, line 28), and

carries out one-dimensional rearrangement processing for obtaining parallel beam projection data from the fan beam projection data obtained from a fan-shaped fan beam viewed from the go-around axis direction generated from said radiation source (Col. 1, lines 64-66).

Flohr et al. fails to explicitly teach a reconstruction means creating a three-dimensional image and

wherein said reconstruction means determines a projection data phase range capable of back projection for each reconfigured voxel.

Flohr et al. fails to teach wherein said reconfiguration means

calculates a straight line,

superimposes said reconfiguration filter on said parallel projection data to generate filter-processed parallel projection data, and

three-dimension back projects the parallel beam projection data subjected to said filter processing based on said determined projection data range capable of back projection to the back projection region corresponding to said region in concern along the approximate irradiation trace using said approximation.

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Silver teaches determines a projection data phase range capable of back projection for each reconfigured voxel (Items 32 and 34).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Flohr et al. to include the determining of Silver, since a person would have been motivated to make such a modification to shorten scan times while maintaining image quality (Col. 1, lines 53-55) as taught by Silver.

Bruder et al. teaches wherein said reconfiguration means

calculates a straight line (Page 876, Col. 1, lines 14-20, i.e. plane of tilted slice), superimposes said reconfiguration filter on said parallel projection data to generate filter-processed parallel projection data (Page 874, Col. 1, lines 32-37), and

back projects the parallel beam projection data subjected to said filter-processing based on said determined projection data range (Page 874, Col. 1, lines 20-22) capable of back projection to the back projection region corresponding to said region in concern along the approximate irradiation trace using said approximation.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the apparatus of Flohr et al. as modified above to include the line and filtered backprojection of Bruder et al., since a person would have been motivated to make such a modification to improve computational efficiency (Page 873, Col. 2, lines 41-42) as implied by Bruder et al.

Tuy teaches a reconstruction means creating a three-dimensional image (Col. 1, lines 18-19 and Col. 4, lines 48-49) and three-dimension back projects (Col. 4, lines 48-49).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the apparatus of Flohr et al. as modified above to include three-dimension back projecting of Tuy, since a person would have been motivated to make such a modification to improve image quality (Col. 3, lines 21-23) as implied by Tuy.

Note: the limitation that an element is “capable of” performing a function is not a positive limitation but only requires the function to perform. It does not constitute a limitation in any patentable sense.

With respect to claim 11, Bruder et al. further teaches wherein  
said reconfiguration means performs redundancy (Page 874, Col. 1, lines 7-9) correction weighting for generating a weighting factor from a weighting function in the phase direction (Sections IIA and IIB, Pages 874-877) to correct data redundancy at each phase according to the phase width of this determined projection data, and

said parallel beam three-dimensional back projection means assigns the weighting factor (Sections IIA and IIB, Pages 874-877) obtained by said redundancy correction weighting means to the projection data within said determined projection data phase range and performs three-dimensional back projection along said approximate trace to the back projection region (Page 874, Col. 1, lines 20-22).

With respect to claim 12, Bruder et al. further teaches wherein in determining said projection data phase range, it is possible to



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determine the phase range of  $f\pi$  radians in the view direction (Page 876, Col. 1, lines 23-27) and

perform redundancy correction using the weighting function by the redundancy correction weighting means (Sections IIA and IIB, Pages 874-877) .

With respect to claim 14, Bruder et al. further teaches wherein in calculating said operating data phase range, the projection data range capable of back projection for each reconfigured voxel is determined so that the phase direction range of the beam back projected for each voxel is set to the narrowest possible range (Page 876, Col. 1, lines 1-3).

10. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Flohr et al. in view of Silver, Bruder et al. and Tuy as applied to claim 10 above, and further in view of Noo et al.

With respect to claim 13, Flohr et al. as modified above suggests the apparatus are recited above. Flohr et al. fails to explicitly teach wherein said operating data phase range determines the projection data range capable of back projection for each reconfigured voxel so that the maximum cone angle of the beam back projected for each voxel becomes narrowest.

Noo et al. teaches wherein said operating data phase range determines the projection data range capable of back projection for each reconfigured voxel so that the maximum cone angle of the beam back projected for each voxel becomes narrowest (Page 564, lines 1-2 and Figure 3a).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to include in the apparatus of Flohr et al. as modified above the determining of Noo et al. to improve image quality (Page 567, lines 7-8) as implied by Noo et al.

### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John M. Corbett whose telephone number is (571) 272-8284. The examiner can normally be reached on M-F 8 AM - 4:30 PM.


If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward J. Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

25 June 2007

JMC



  
EDWARD J. GLICK  
SUPERVISORY PATENT EXAMINER